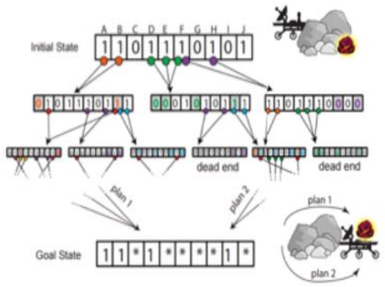
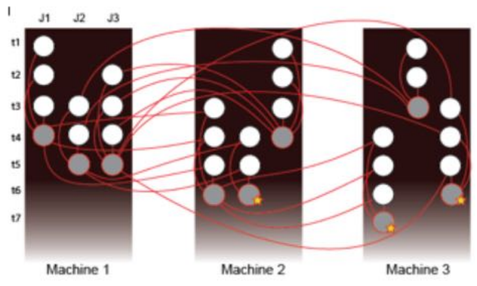
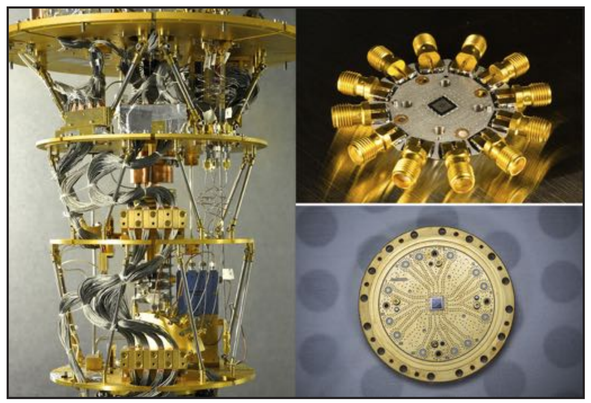
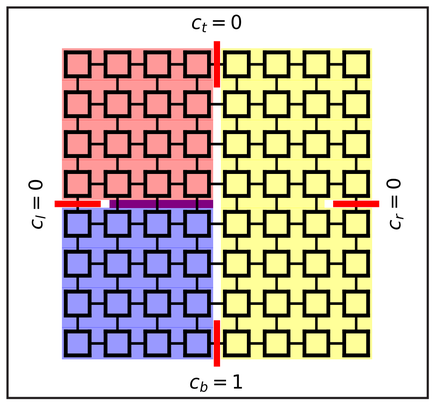




The QuAIL team collaborates with diverse NASA groups facing computational challenges, leveraging their domain expertise to assess the potential impact of quantum computing on specific problems in aeronautics, Earth sciences, material sciences, and space exploration. Examples of current NASA quantum computing applications research include securing future air traffic communication networks (top) and planning (bottom), which encompasses navigation, scheduling, and asset allocation, including job shop scheduling.
Davide Venturelli, Universities Space Research Association; Parimal Kopardekar, NASA



NASA's QuAIL research efforts utilize supercomputing, analysis, and emerging quantum hardware available through partnerships. Left: D-Wave quantum annealer housed at NASA's Ames Research Center through a partnership with Google and Universities Space Research Association. Right: quantum processors being developed at Google (top) and Rigetti Computing (bottom). *John Hardman, NASA/Ames; Erik Lucero, Google; Rigetti Computing*



Simulating quantum circuits on a classical supercomputer is extremely challenging, with an exponential slowdown in the typical case. NASA's novel HPC quantum circuit simulation approach enables researchers to simulate larger circuits than anyone was able to simulate previously. Applications include benchmarking quantum hardware and exploring quantum algorithms. *Salvatore Mandra, Chris Henze, NASA/Ames*

National Aeronautics and Space Administration

An Exciting Year in Quantum Computing Research at NASA

NASA's Quantum Artificial Intelligence Laboratory (QuAIL) at Ames Research Center is the hub for assessing the potential impact of quantum computers on computational challenges that will be faced by NASA missions in the coming decades. The power of quantum computing comes from encoding information in qubits—non-classical units of information which enable unconventional computation that takes advantage of quantum tunneling, interference, and entanglement. As part of its assessment, the QuAIL team develops quantum and hybrid quantum-classical algorithms, maps problems to quantum algorithms, devises programming and compilation strategies, characterizes hardware, and furthers fundamental understanding of how to harness quantum effects for computational purposes.

Eleanor Rieffel, Rupak Biswas, NASA Ames Research Center